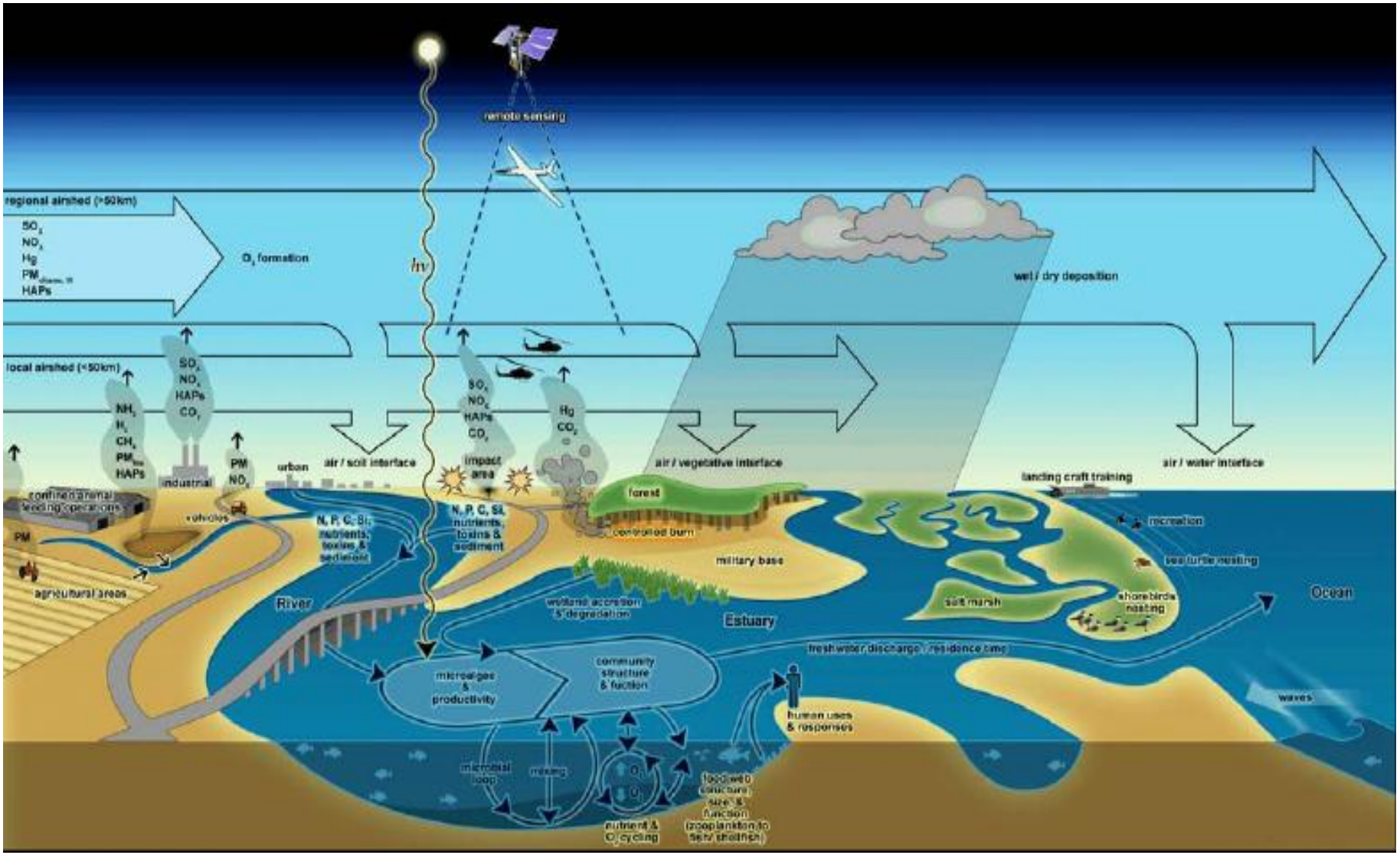
Defense Coastal/Estuarine Research Program



http://www.serdp.org/

The Strategic Environmental Research and Development Program

• DoD's environmental science and technology program, planned and executed in full partnership with the DoE and the EPA, with participation by numerous other federal and non-federal organizations.

• focuses on cross-service requirements and pursues high-risk/high-payoff solutions to the Department's most intractable environmental problems.

• the development and application of innovative environmental technologies support the long-term sustainability of DoD's training and testing ranges as well as significantly reduce current and future environmental liabilities.

- support from backing agency is critical!

Problem Statement

Critical military training and testing lands along our nation's estuarine and coastal shorelines are increasing placed at risk from;
(1) development in surrounding areas,
(2) impairments due to anthropogenic disturbances, and
(3) increasing requirements for compliance with environmental regulations.

DCERP is SERDP's commitment of at least 10 years to conducting ecosystem based research through basic and applied science at MCB Camp Lejeune. We are currently in year three.

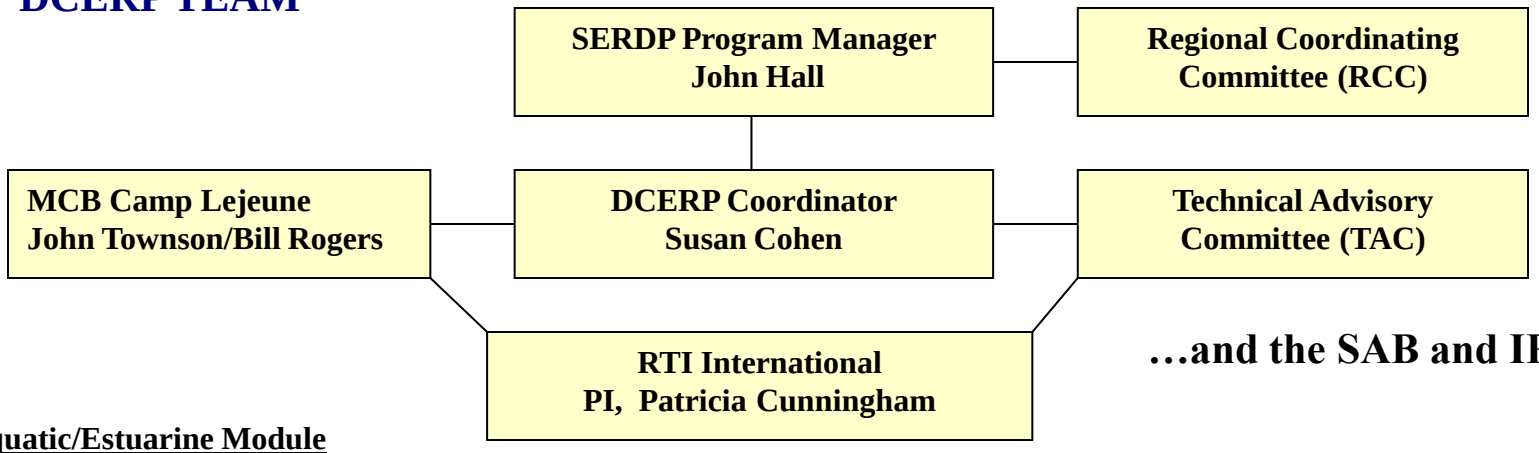
Program Objectives

- conduct mission-relevant and basic and applied research in support of an ecosystem-based management approach

- enhance and sustain the military mission by developing an understanding of coastal and estuarine ecosystem composition, structure, and function within the context of a military training environment

MCB Camp Lejeune provides an ideal platform for DCERP - it integrates coastal barrier island, aquatic/estuarine, marsh/wetlands, and terrestrial ecosystems.

DCERP TEAM



…and the SAB and IPR

Aquatic/Estuarine Module
Hans Paerl – UNC Chapel Hill Institute of Marine Science
Iris Anderson – Virginia Institute of Marine Sciences
Michael Piehler – UNC Chapel Hill Institute of Marine Science
Rachael Noble – UNC Chapel Hill Institute of Marine Science
Jerad Bales – USGS Raleigh Office
Mark Brush – Virginia Institute of Marine Sciences

26 PhDs
17 PhD and Masters students
2 Post-Docs
18 technicians

Coastal Wetlands Module
James Morris – University of South Carolina
Carolyn Currin – NOAA Morehead City Laboratory
Mark Fonseca – NOAA Morehead City Laboratory
Craig Tobias – UNC-Wilmington

Coastal Barrier Module
Pete Peterson – UNC Chapel Hill Institute of Marine Science
Antonio Rodriguez – UNC Chapel Hill Institute of Marine Science
Stephen Fegley – UNC Chapel Hill Institute of Marine Science
Rick Luettich – UNC Chapel Hill Institute of Marine Science
Jessie McNinch – US Army Corps of Engineers
Sarah Karpanty – Virginia Polytechnic Institute and State University
Jim Fraser –Virginia Polytechnic Institute and State University

Terrestrial Module
Norm Christensen – Duke University
Jeff Walters – Virginia Polytechnic Institute and State University
Pat Halpin – Duke University

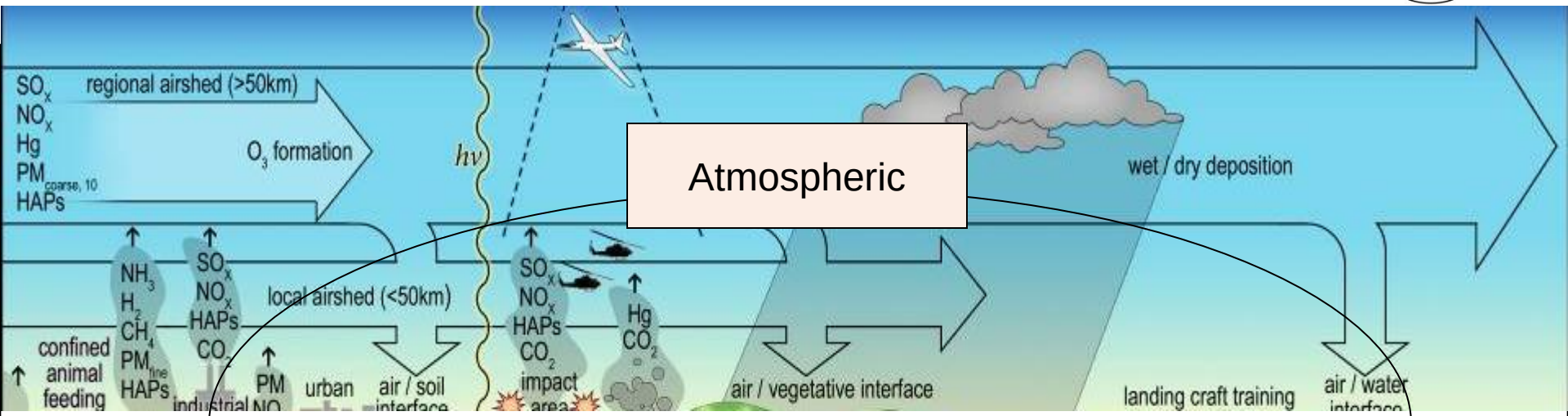
Atmospheric
Karsten Baumann – Atmospheric Research and Analysis, Inc.
Wayne Robarge – North Carolina State University

Data Management Module
Danette Boezio – RTI International
Pat Halpin – Duke University
Ken Reckhow – Duke University

Major Functions/Roles of the TAC

- Experts from academia, industry, and military provide scientific/technical review and guidance to ensure quality and relevance of DCERP
- Meetings – yearly briefing
- Assesses scientific vision, technical requirements, and technical and scientific issues related to DCERP's implementation/operation
- DCERP Coordinator runs the TAC

DCERP APPROACH



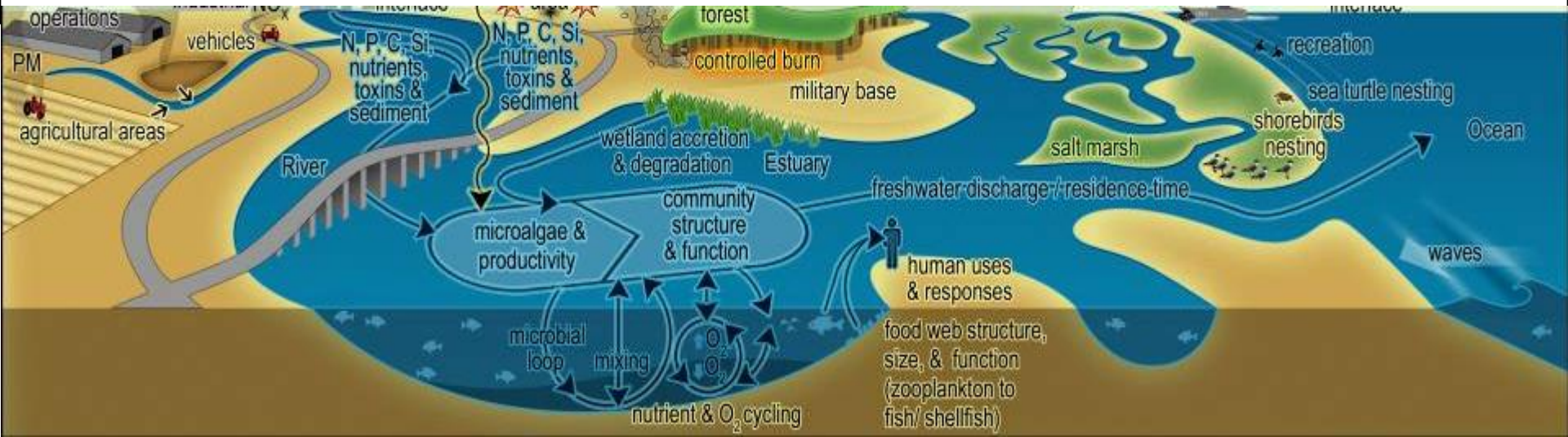
Atmospheric

Terrestrial

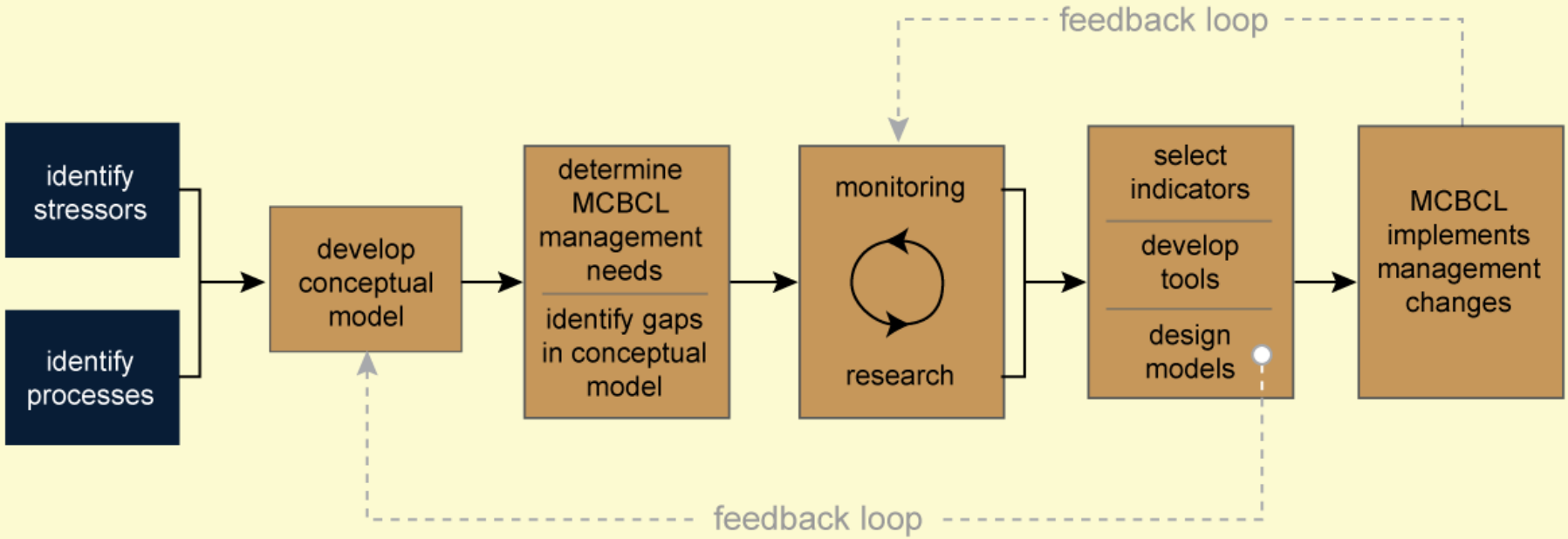
Aquatic / Estuarine

Coastal Wetlands

Coastal Barrier



Technical Approach



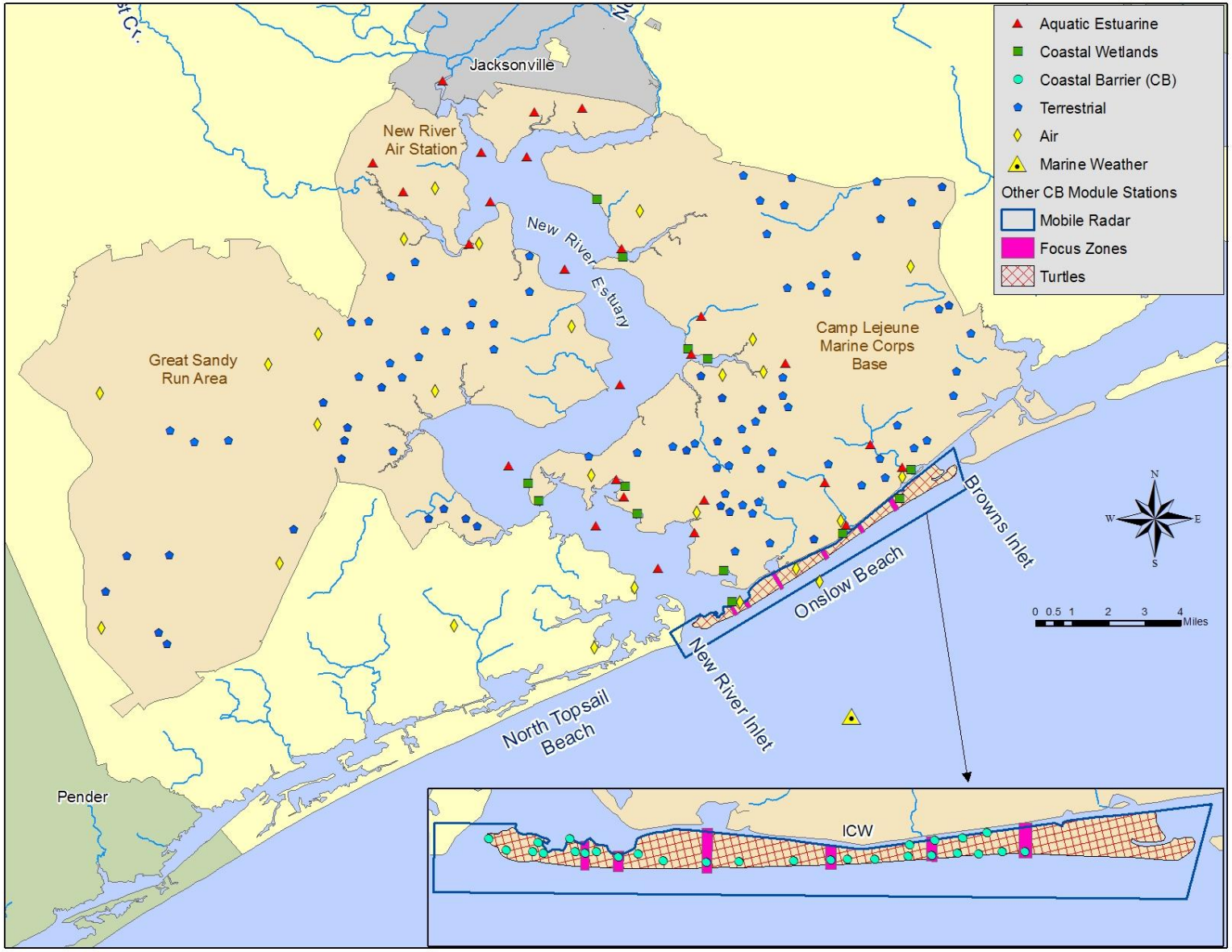
Phase I, Planning	Phase II, Implementation

-understanding of ecosystem function and processes began our step-wise process towards ecosystem based management and refinement of research direction

Technical Objectives
(developed from Base specific drivers)

- Develop an integrated ecosystem monitoring plan that transcends air–land–water boundaries to study effects of ecological change across the MCBCL.
- Implement a cost-effective, baseline monitoring plan with practical application that enables MCBCL managers to deploy it on a long-term basis.
- Improve our understanding of Base-specific and off-site stressors.
- Identify underlying system processes and stressor-specific indicators of ecosystem change.
- Identify critical thresholds for these indicators that can be used as benchmarks of ecosystem change that could threaten military sustainability of the MCBCL.
- Develop adaptive management strategies for sustainable management.

Monitoring/Research Stations



Monitoring Activities

Module	Activities
Aquatic/ Estuarine[a]	**Hydrodynamics:** Stream flow and discharge (New River and creeks) **Chemistry:** Nutrients, salinity, pH, oxygen, temperature (New River, NRE, and creeks) **Sedimentology:** Total suspended solids (New River and creeks), turbidity (NRE) **Biology:** Primary productivity, phytoplankton, fluorescence (NRE)
Coastal Wetlands	**Landcover and shoreline erosion:** Location and elevation **Hydrodynamics:** Tide gauges (hydroperiod) **Chemistry:** Nutrients, salinity, hydraulic conductivity (shallow groundwater) **Sedimentology:** Accretion rates, organic content, particle size
Coastal Barrier	**Hydrodynamics:** Wave velocity, wave heights/period, currents, shoreline position **Meteorology (ocean):** Air temperature, wind velocity, barometric pressure, humidity, solar radiation **Sedimentology:** Texture and composition **Biology:** Benthic invertebrates, shorebirds/seadbirds, dune/shrub/marsh vegetation, sea turtles, fish
Terrestrial	**Landcover/land use:** Determine changes in landcover/ land use (vegetation types, buildings, roads) and determine military training impacts **Biology:** Vegetative community assessment, fuel load **Soil:** Soil bulk density, pH, organic matter content
Atmospheric	**Meteorology (air):** Wind speed, wind direction, relative humidity, temperature, radiation, precipitation **EPA Criteria Polluants:** Ozone, fine particulate matter (mass and composition

[a] Sedimentology, chemistry, and biology of the NRE benthic zone are characterized by Research Project AE-3.

Aquatic/Estuarine Module

The Aquatic/Estuarine Module examines the tidal reach of the NRE from the freshwater head of the New River to the tidal inlet.

Monitoring Activities

Hydrodynamics: Stream flow and discharge (New River and tributary creeks)
Chemistry: Nutrients, salinity, pH, oxygen, temperature (New River, New River Estuary [NRE], and tributary creeks)
Sedimentology: Total suspended solids (New River and tributary creeks), turbidity (NRE)
Biology: Primary productivity, phytoplankton, fluorescence (NRE)

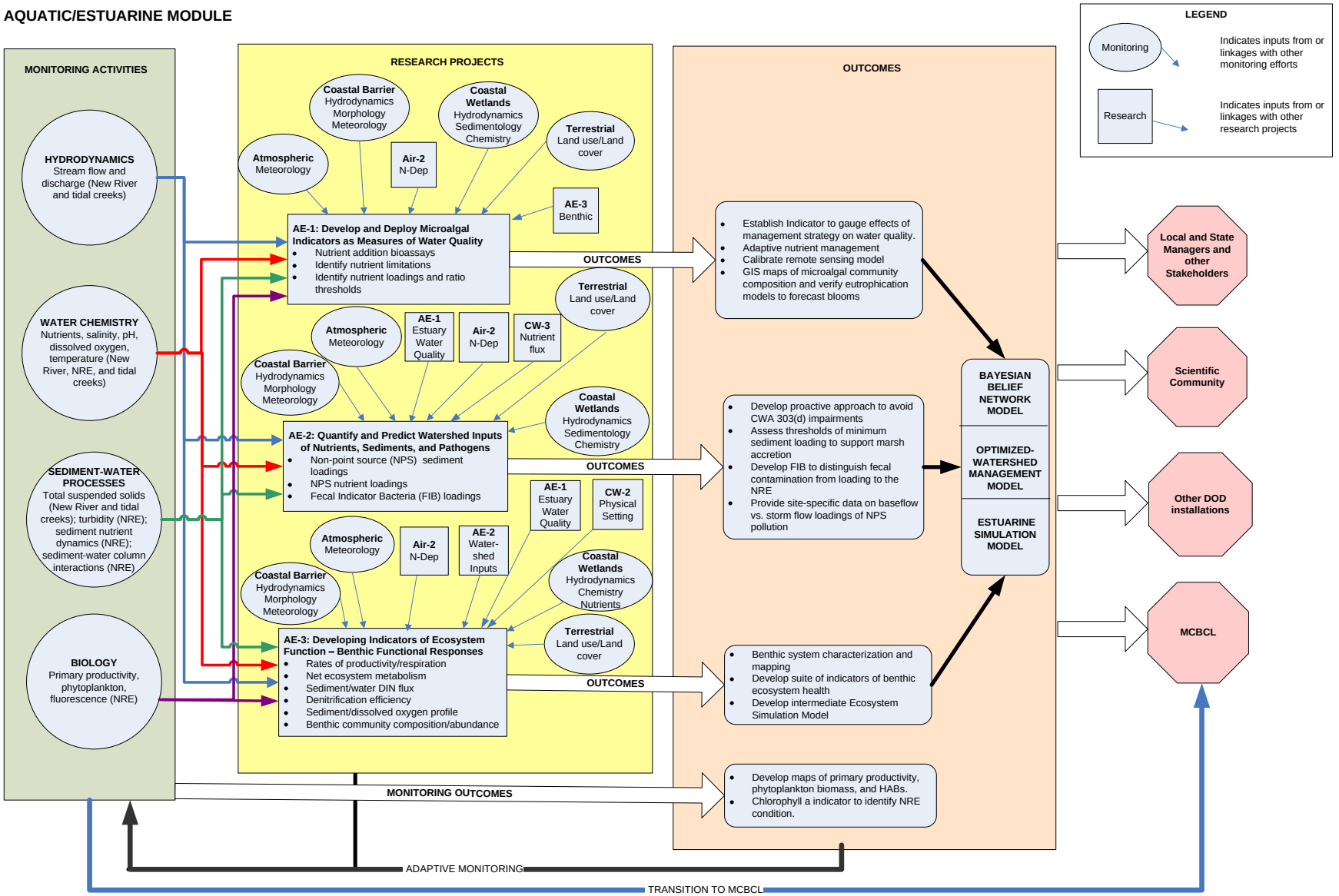
Research Projects

Develop and Deploy Microalgal Indicators as Measures of Water Quality, Harmful Algal Bloom Dynamics, and Ecosystem Condition

Quantifying and Predicting Watershed Inputs of Nutrients, Sediments, and Pathogens

Developing Indicators of Ecosystem Function for Shallow Estuaries: Benthic Functional Responses in the New River Estuary (NRE)

Aquatic/Estuarine Module Roadmap



Coastal Wetlands Module

The coastal wetlands of this module are defined as the vegetated and non-vegetated intertidal habitat in salt and brackish waters and include marshes and adjacent mudflats, sandflats, and tidal creeks.

Research Projects

Determine Responses of Marsh Vegetation and Accretion to Relative Surface Elevation

Forecast Influence of Natural and Anthropogenic Factors on Estuarine Shoreline Erosion Rates

Hydraulic Exchange and Nutrient Reactivity in the NRE Wetlands

Spartina marshes of the ICW fertilized with nitrogen, phosphorus, or nitrogen plus phosphorus to determine which nutrient(s) control productivity.

Coastal Barrier Module

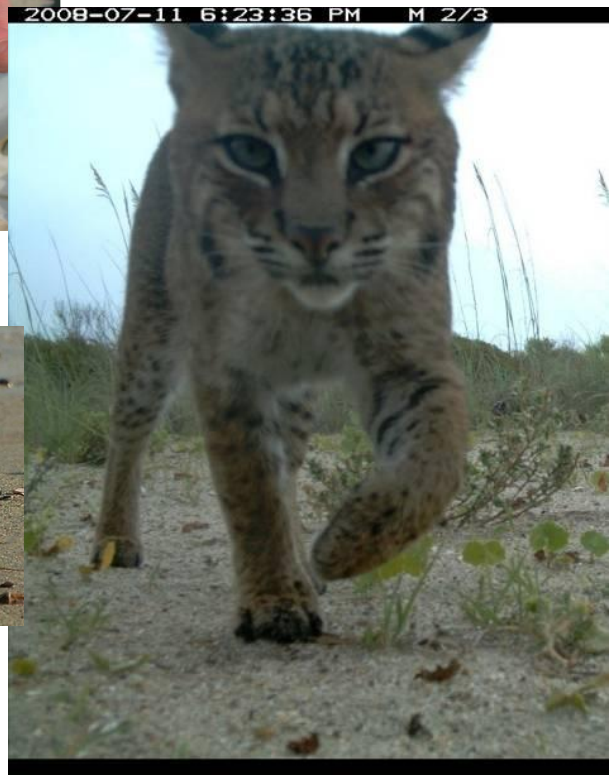
This module encompasses the shallow subtidal and intertidal shore face, tidal inlet, backshore beach, aeolian dune, shrub zone, incipient maritime forest, and washover sand flat habitats.

Research Projects

Short-Term Barrier Evolution Related to Storms and Land Use

Long-Term Barrier Evolution Related to Variations in Underlying Geology, Land Use, and Inlet Dynamics

Understanding the Top-Down and Bottom-Up Drivers of Shorebird Nest Success and Habitat Use in Relation to Beach Management Practices on MCBCL



Terrestrial Module

The terrestrial ecosystem refers to the gradient of vegetation from salt marsh at the estuary margin, through brackish/freshwater marsh, to the longleaf pine savannas and pocosins.

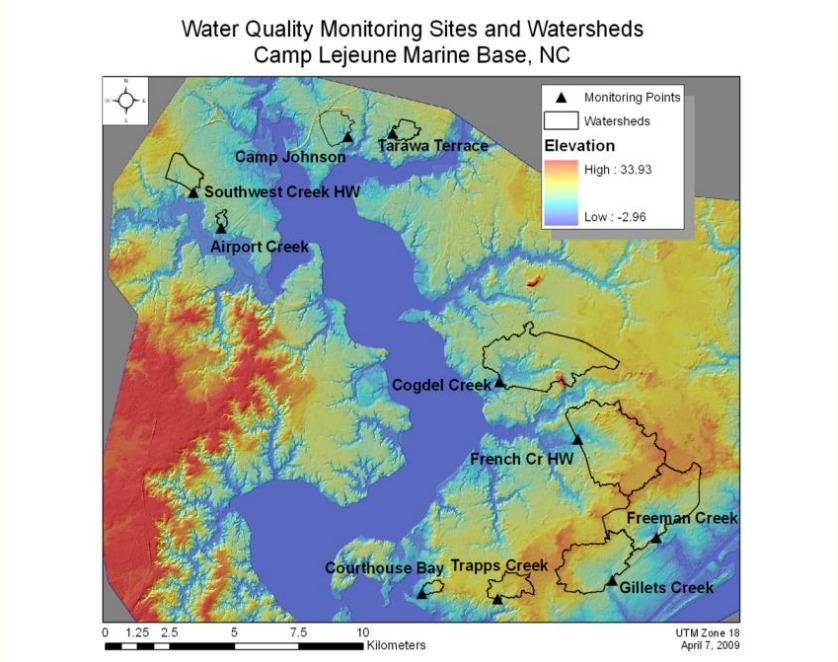
Research Projects

Effects of Different Midstory Restoration Management Options on Terrestrial Ecosystem Structure and Function

Effects of Habitat Management for Red-Cockaded Woodpeckers on Bird Communities

Landscape Change

Compare land use/land cover characteristics among watersheds and assess impacts on stream water quality and down stream marshland characteristics.



Atmospheric Module

The monitoring activities and research projects of the Atmospheric Module will help describe and improve the understanding of critical pollutant transport and advection processes that are subject to complex land-sea-breeze circulation patterns and their effect on the atmospheric abundance and composition of a variety of air pollutants

Research Projects

Optimization of Prescribed Burning by Minimizing Smoke Emissions and Maximizing Vitality of Fire-Adapted Ecosystems

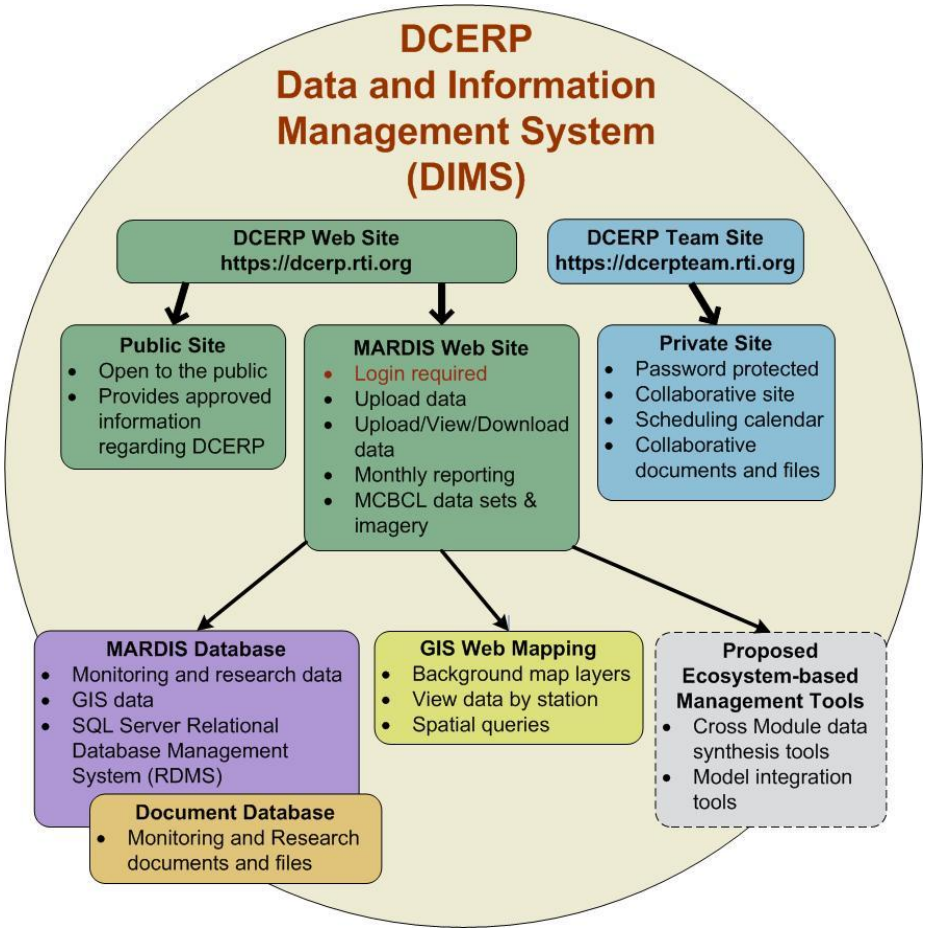
Nitrogen Deposition to Terrestrial and Aquatic Ecosystems

DCERP Data Information Management System (DIMS)

Data Management Module

Objective: Design and maintain a centralized system that enables accurate storage, analysis, integration, sharing, output, and broad data management functions to support the complex and voluminous DCERP environmental data.

Benefit to the Base: Supports MCBCL's long-term, ecosystem-based data management needs and provides a legacy of environmental data for all ecosystems as a reference against which to assess future change.



Benefits of MARDIS

- Standardized data format & centralized location for DCERP data
- Efficient integrated analysis & synthesis of all data collected within and across all 5 ecosystem modules
- Metadata for unambiguous data interpretation

Transition Plan

SERDP
Technical Advisory Committee – 1 time/yr (March beginning 2009)

MCBCL
EMD – 1 time/yr and ongoing meetings with DCERP Coordinator
Lunch and Learns session presented by DCERP Researchers
Technical Information Briefings presented by DCERP Researchers

Local Stakeholders
Onslow Bight Conservation Forum
New River Round Table
Marine Science Education Partnership
Regional Coordinating Committee – SERDP, DCERP PI, Coordinator & MCBCL attend annual meeting and PI briefs members on DCERP progress

Scientific Community
Peer reviewed publications/Presentations and posters at professional conferences

- All scientists meetings to foster integration and synthesis throughout the program

Questions and Comments?

Contact info: Susan Cohen
susan.cohen@usmc.mil
910-451-7900

DCERP website: https://dcerp.rti.org/

Technical Advisory Committee

Dr. William Boicourt – Horn Point Environmental Laboratory, University of Maryland

Ms. Margit Bucher – Fire Manager/Assistant Director for Science, The Nature Conservancy

Dr. Michael Chang – School of Earth and Atmospheric Sciences, Georgia Institute of Technology

Dr. Ellis B. Cowling – Colleges of Natural Resources & Agriculture and Life Sciences, NCSU

Mr. John Fussell – Independent Consultant, Morehead City, NC

Dr. Wendell Gilliam – Department of Soil Science, North Carolina State University

Dr. Martin E. Lebo – Senior Aquatic Scientist, Weyerhaeuser Company

Dr. Stanley Riggs – Department of Geological Sciences, East Carolina University

Dr. Ray Torres – Department of Geological Sciences, University of South Carolina

Dr. Robert R. Twilley – Department of Oceanography and Coastal Sciences, Louisiana State Univ.

Regional Coordinating Committee

Fred Annand - The Nature Conservancy, Durham, NC

Dean Carpenter - Albemarle-Pamlico National Estuary Program, Raleigh, NC

Pat Donovan-Potts - New River Roundtable, Jacksonville, NC

Michelle Duvall – North Carolina Division of Marine Fisheries, Morehead City, NC

John Fear - North Carolina National Estuarine Research Reserve, Beaufort, NC

Patti Fowler - NC Division of Environmental Health, Morehead City, NC

John Hammond - US Fish and Wildlife Service, Raleigh, NC

Jon Harrison - Director, Environmental Health Division, Onslow County, Jacksonville, NC

Lee Thornhill -USDA Forest Service, Croatan District, New Bern, NC

Tommy Hughes - North Carolina Wildlife Resource Commission, New Bern, NC

Carmen Lombardo - Environmental Affairs, Marine Corps Air Station, Cherry Point, NC

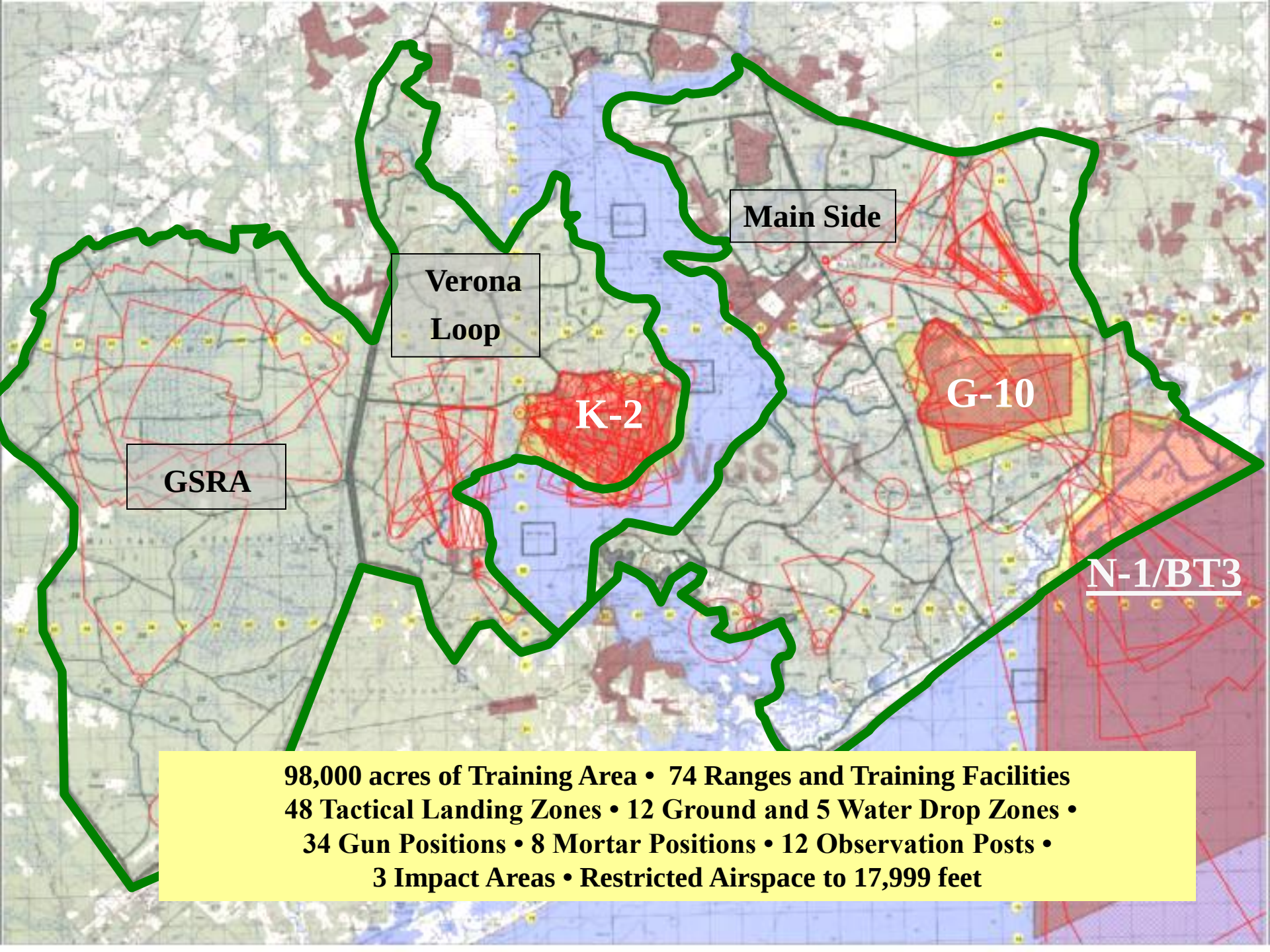
Todd Miller- North Carolina Coastal Federation, Newport, NC

Scott Pohlman - North Carolina Natural Heritage Program, Raleigh, NC

Diana Rashash - North Carolina Cooperative Extension, Jacksonville, NC

Linda Rimer - Environmental Protection Agency, Research Triangle Park, NC

Jay Sauber - NC Department of Environment and Natural Resources, Raleigh, NC


Main Side
Verona
Loop
K-2
G-10
GSRA
N-1/BT3
98,000 acres of Training Area • 74 Ranges and Training Facilities
48 Tactical Landing Zones • 12 Ground and 5 Water Drop Zones •
34 Gun Positions • 8 Mortar Positions • 12 Observation Posts •
3 Impact Areas • Restricted Airspace to 17,999 feet

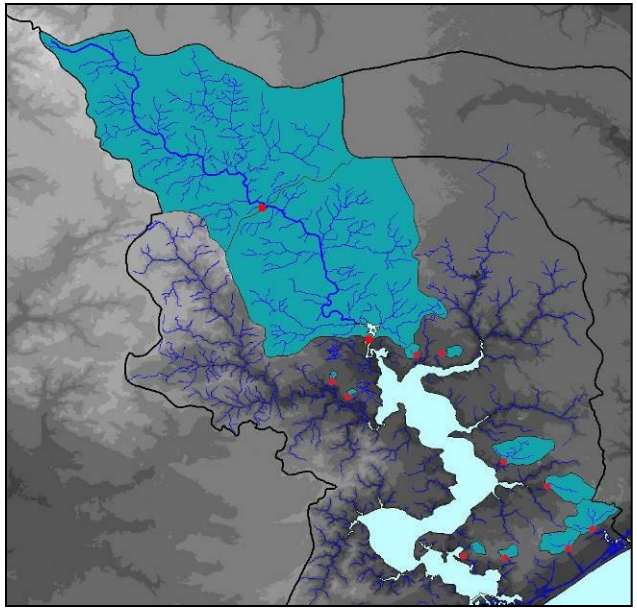
Aquatic/Estuarine Module Monitoring Components

Area	Variable	Spatial Scale	Temporal Scale
New River	Water level and discharge	2 stations: New River near Gum Branch (active USGS station) and at Jacksonville	Continuous
	Nutrients and sediment	New River at Jacksonville	Monthly (outgoing tide)
	Water temperature, dissolved oxygen (DO), pH, and salinity	New River at Jacksonville	Continuous
Tributary creeks	Water level (stream flow) and temperatures	10 stations (paired)	Continuous
	Nutrients (dissolved inorganic nitrogen [DIN], dissolved inorganic phosphorus [DIP], dissolved organic nitrogen [DON], total nitrogen [N], total phosphorus [P]), total suspended solids (TSS), and fecal indicator bacteria (FIB)	10 stations (paired)	Grab; monthly (base flow); episodic (storm flow)
New River Estuary—water column	Fluorescence (chlorophyll *a*), colored dissolved organic matter (CDOM), DIN, N, DIP, P, and TSS	8 stations (vertical profilers and continuous autonomous vertical profilers)—longitudinal from the New River to the inlet	Monthly for profiles and data flow; year-round for AVPs; more intensive (March–October)
	Photosynthetically active radiation, salinity, water temperature, DO, pH, turbidity, flow, and precipitation		Monthly for profiles and data flow; year-round for AVPs; more intensive (March–October)
	Primary productivity, chlorophyll *a* by fluorometry and high performance liquid chromatography, phytoplankton pigments/counts		Monthly for profiles AVPs and data flow

Synthetic Integrative Modeling

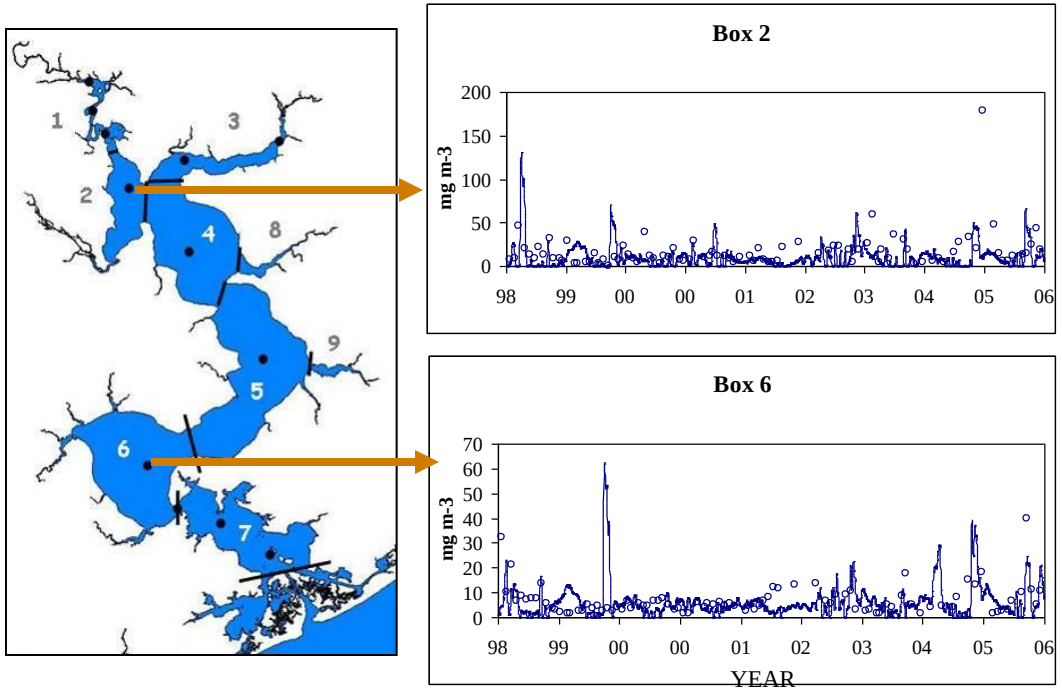
Watershed Simulation Model

- Determine annual cycle of pollutant loadings
- Will predict the response of watershed flows and associated loads of nutrients and sediments due to natural and anthropogenic stressors, including development and land use change on the base.



Estuarine Simulation Model

- Hydrodynamic box model
- Predicts the response of the New River Estuary to loads and stressors with respect to water quality and the state chlorophyll standard, and can be used to set load reduction targets when necessary.



Initial ESM Results: Phytoplankton Chl-*a*